

# Research Summary

## TITAN – An Interactive Web-based Platform for Transportation Data InTeGration and ANalytics

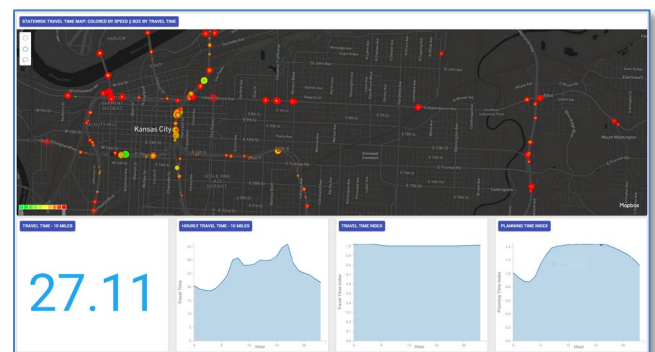
An exponential growth in relevant data streams (e.g. traffic, geometric, safety, pavements, crowd-sourced) has brought new opportunities and challenges in the realm of transportation data warehousing. Increased data enables improved planning, monitoring, prediction, and management of transportation systems, but only if the manipulation of such gigantic datasets could be automated efficiently.

With the increasing demand for modern data warehousing, there has been a significant growth in commercial and open-source tools. TITAN was developed utilizing a completely open-source platform that leverages recent advances in big data analytics to efficiently process multiple streams of data and deploy applications that will enable transportation personnel to make practical, data-driven decisions.

TITAN has two main components: a data center and an applications center. The data center stores different streams of datasets and provides a user-friendly interface for querying the different databases. By leveraging cluster computing and recent advances in big data analytics, TITAN is able to generate responses to different forms of user queries at a much faster rate compared to traditional data warehouses.



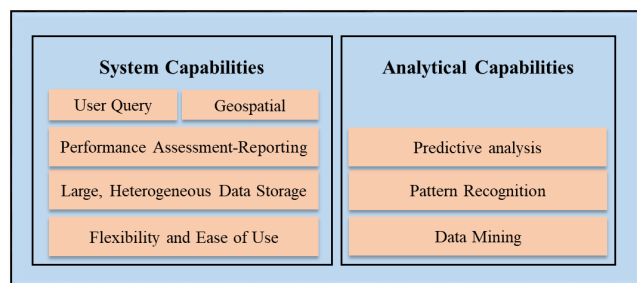
The second component of TITAN is the APPCENTER (Applications Center) which hosts a variety of applications for performance monitoring, data integration and predictive analytics. The APPCENTER is powered with fast, interactive visualizations that enable users to identify trends and insights quickly for decision making. The APPCENTER was developed on top a Graphical Processing Unit (GPU) database which enables it to perform computations on large datasets within fractions of a second. Examples of applications in the APPCENTER include crash risk prediction, safety-mobility performance measures, and traffic surveillance, as shown below.



Web-Based Interactive Visualization and Analytics

The following figure summarizes the unique system and analytical capabilities of the TITAN platform. The customized dashboards developed in TITAN can be used to communicate

performance measures on different transportation infrastructure or assets. TITAN can serve both real time and static dashboards, depending on agency needs. As data streams are ingested into TITAN, the dashboards will be automatically updated. The platform is enabled with graphical processing units (GPUs) and machine learning algorithms to power predictive analytics.



#### Analytical and System Capabilities of TITAN

A public agency, like the Missouri Department of Transportation (MoDOT), compiles and stores large amounts of data from various sources, both public and commercial. For example, automated road analyzer (ARAN) vans collect pavement condition information, count stations and counters gather traffic volumes, the Missouri Highway Patrol compiles crash reports, and third-party vendors assemble crowd-sourced GPS-located data. Traditionally, each source of information served a limited number of purposes, sometimes one only. For example, location data has been used to estimate travel times and traffic volumes to estimate annual average daily traffic. But what if all these types of information were tightly integrated together so that a particular application, project or location can utilize all relevant databases?

An application like TITAN allows MoDOT to harness the wealth of existing data sources and to do so efficiently and easily via graphical tools. As TITAN is a prototype software, this final report also serves as a user manual.

#### Project Information

**PROJECT NAME:** TITAN – An Interactive Web-based Platform for Transportation Data InTegration and ANalytics

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**PROJECT COST:** \$24,992

**LEAD CONTRACTOR:** University of Missouri-Columbia

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